I&L CONSULTING Ltd

# Crabtree Lane, Clayton

## Flood Risk Assessment

Chancerygate Manchester Limited

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| Final | 15.12.23 | Submission for Full Planning | IL | Ismail Laher | Director |
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# 1. Introduction

I&L Consulting Limited (I&L) was commissioned by the Applicant, Chancerygate Manchester Limited, to undertake a Flood Risk Assessment (FRA) for a proposed industrial development located in a predominantly employment area area on Crabtree Lane in Clayton, Manchester. The site lies within the authority of Manchester City Council (MCC).

The relevant national planning guidance is set out by the National Planning Policy Framework (NPPF, updated in 2023). An FRA must assess all sources of flood risk both to the proposed development itself and the potential impact on people and property elsewhere within the catchment.

## 1.1 Study Aims and Objectives

The overall objective of this study was to carry out an FRA that meets the requirements of the NPPF and MCC flood risk policies. These consider surface water runoff management and the specific needs of the Environment Agency (EA), MCC and United Utilities. The study is required to assess all aspects of flood risk to the proposed development, the potential impacts of the development on people and property elsewhere within the catchment and identify possible mitigation measures to ensure that the development is safe in the event of a flood. To achieve this aim, the following key actions were undertaken:

- Obtain flood data from the EA and MCC.
- Review topographical and flood risk data to identify the existing flood risk posed to the site from all sources.
- Assess the residual flood risk post-development.
- Consider the vulnerability of the users and the development, taking account of the vulnerability classification;
- Assess the safety of the route of access/egress from the site in a flood event;
- Identify suitable mitigation measures to protect the development site against flooding; and
- The production of a conceptual surface water drainage strategy for the proposed development.

## 1.2 Scope of Works

In order to meet the above objectives, the following scope of work and tasks were undertaken:

- **Task 1: Data Collection.** I&L Consulting collected relevant available information on the nature of the flooding at the site. The Applicant and their consultant team have provided information about the site and proposed development layout and design.
- **Task 2: Identification of Current and Post-Development Flood Risk.** The existing and post-development flood risk posed to the site was assessed from the data that was collected in Task 1. The assessment identifies the flood risk from all potential sources of flooding and includes consideration of the impact of climate change on flood risk.
- **Task 3: Assessment of Site Safety**. I&L Consulting considered whether flood resilience measures needed to be undertaken and the safety of the route of access/egress from the site.

## 1.3 Data Collected

Table 1 lists the data that has been collected as part of this assessment. Comments on the source and the nature of the data are also provided.

### Table 1: Collected Data

| Purpose | Data and Source | Comments |
|---|---|---|
| Identification of site location | Ordnance Survey Map | Identifies the position of the site and local hydrological features |
| Identification of flood risk | Environment Agency Flood Map | Risk of flood from tidal and fluvial sources |
| | Topographical Survey | Existing site levels and topography |
| | Development details (drawings for existing site and proposed development) | Information on the layout of the proposed development |
| | Strategic Flood Risk Assessment (SFRA) | Reports that identify existing flood risk information within the area and considerations for development. |
| Identification of the existing drainage network | Sitewide Drainage Plan | Asset plans and drainage drawings identify public and private sewers nearest to the site. |
| Identification of ground conditions | British Geological Society (BGS)<br><br>BH Logs and site investigation reports | Identifies the type of aquifer, groundwater level, permeability and geotechnical information |

# 2. Planning Policy and Evidence

## 2.1 National Planning Policy Framework (2023)

The NPPF sets out what needs to be taken into account by developers to assess whether a proposed development is likely to be at risk of flooding or has the potential to increase flood risk elsewhere. Within the recently published NPPF (2023), the principles relating to flood risk management remain mostly unchanged from the 2021 version.

The overall objective of the NPPF is to steer development towards areas of lowest flood risk. NPPF policy aims to ensure flood risks have been taken into account and appropriate measures put in place to ensure that:

- The development is safe;
- Where possible, the flood risk overall is reduced;
- Increased flood risk does not occur elsewhere; and
- Appropriate mitigation measures are employed to deal with these effects and risks.

Paragraph 167 and footnote 55 of the NPPF outlines that a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The EA Flood Map shows the site to be located within Flood Zone 1 and less than 1 ha.

The NPPF considers the vulnerability of different forms of development to flooding; and classifies the proposed development as 'Less Vulnerable'.

## 2.2 Manchester City Council - Core Strategy 2012-2027

The proposed development is not subject to any specific designations according to the Development Plan.

**FLOOD RISK POLICY EN14**

**Policy EN 14**

**Flood Risk**

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.
- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

**WATER QUALITY POLICY EN17**

> **Policy EN 17**
>
> **Water Quality**
>
> With reference to the Manchester-Salford-Trafford SFRA and other relevant documents:
>
> - Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological;
> - Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses;
> - Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site;
> - Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse beneath the site to improve the ecological status of that watercourse.

### 2.3 Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA: March 2011

A review of this document shows that the proposed site lies outside of any areas identified to be at risk from flooding. The site is located within the 'Conurbation Core' Critical Drainage Area as mapped out by JBA Consulting.

### 2.4 Manchester City Council Local Flood Risk Management Strategy: Adopted March 2014

A review of the maps contained within this document shows that the proposed site lies outside of any areas identified to be at risk from surface water flood, any recorded flooding incidents and in an area low risk from groundwater flooding.

### 2.5 Manchester City Council Preliminary Flood Risk Assessment: May 2011

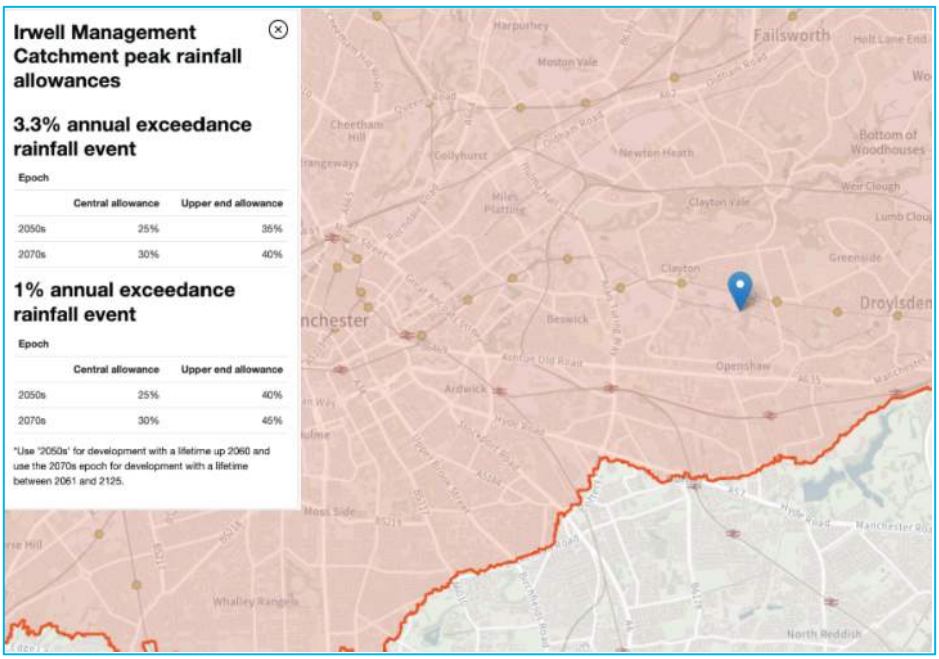
A review of this document shows that the proposed site lies outside of any areas identified to be at risk from surface water flood, any recorded flooding incidents and in an area low risk from groundwater flooding.

### 2.6 Climate Change

Predicted future change in peak river flows caused by climate change are provided by the EA within their online guidance1. The UK has been split into a series of regionalised 'River Basin Districts'. These River Basin Districts are further split into Management Catchments, for which a range of climate change projections have been applied.

The Proposed Development falls within the Irwell Management Catchment. The extract below identifies the relevant peak rainfall allowances from this Management Catchment.

[1] Environment Agency, Flood risk assessments: climate change allowances: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1



**Irwell Management Catchment peak rainfall allowances**

**3.3% annual exceedance rainfall event**

Epoch

| | Central allowance | Upper end allowance |
|---|---|---|
| 2050s | 25% | 35% |
| 2070s | 30% | 40% |

**1% annual exceedance rainfall event**

Epoch

| | Central allowance | Upper end allowance |
|---|---|---|
| 2050s | 25% | 40% |
| 2070s | 30% | 45% |

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.



When determining the appropriate allowance for use in an FRA the anticipated lifespan of the development should be considered. This Proposed Development is expected to have a design life which goes beyond 2060.

The EA guidance is to use the central allowance for the 2070s epoch (2061 to 2125), which gives values of 30% for the 3.3% (30yr) and 30% for the 1% (100yr) rainfall events. The value of **45%** has be used in the surface water calculations appended to this report as required by MCC.

# 3. Site Description

The proposed development site which is the subject of this Flood Risk Assessment (FRA) is situated in a small industrial estate off the A662 Ashton New Road, Clayton situated east of central Manchester. The development will be accessed off Crabtree Lane which runs along the western boundary of the site.

The proposed development will consist of two blocks of terraced industrial units and a single industrial unit with associated parking and HGV turning areas. The total development site is generally flat with a total site area of 0.9Ha.

The existing site is brownfield with a large warehouse building occupying most of the site and associated external areas of parking and storage to the front and rear of the site.

An underground utility scan of the site has identified separate foul and surface water drainage networks with drainage gully's draining external areas of the site. The survey also identified a combined sewer located in Crabtree Lane, see **Appendix A.**

The United Utilities asset map shows a combined sewer located in Crabtree Lane to the west of the site with a length of combined sewer entering the site, see **Appendix B**.

The proposal would be to drain the developed Sites surface water runoff separately from the foul by gravity and discharge at a restricted rate using flow control to the existing combined public sewer network, see **Appendix D**.

The site location plan is shown in Figure 1 below.

**Figure 1: Site Location Plan**

### 3.1 Topography and Hydrological Setting

Environment Agency (EA) river mapping shows that the nearest 'main river' is the River Medlock which lies approximately 1.1km to the north of the site. The Ashton Canal lies approximately 50m to the south of the site.

The topographic survey (**Appendix A**) indicates that the site levels generally lie between 84.90 and 83.60 m AOD with the floor level of the existing building at 84.65m AOD.

## 3.2 Geology and Hydrogeology

A Phase I & II Ground Investigation Report dated July 2023 has been completed by TRC. Results from the site-specific intrusive investigations can be summarised as follows:

| Stratum | From | | To | | Thickness (m) |
|---|---|---|---|---|---|
| | m bgl | m aOD[1] | m bgl | m aOD[1] | |
| Made Ground | 0.00 | 84.00 | 2.00 - 4.20 | 82.00 – 79.80 | 2.00 – 4.20 |
| Till | 2.00 – 4.20 | 82.00 – 79.80 | >15.45 | <68.55 | >13.25 |

**Ground conditions**

The site is generally covered in Asphalt and concrete over made ground of 4.2m thick. The Made Ground is predominantly granular and comprises either dark grey / black silty gravelly sand or grey very sandy gravel. Below this Made Ground there is Superficial deposits of Till. The base was not confirmed but a maximum depth of 15.45m bgl was recorded. The Till predominately comprises soft to very stiff brown sandy slightly gravelly clay or toward the west boundary loose to very dense brown silty sand or loose to very dense brown silty sandy gravel.

**Hydrogeology**

Groundwater was encountered 4m bgl in the made Ground and 15.30m bgl within the Till. Subsequent resting levels were recorded between 2.2m bgl and 6.48m bgl.

The nearest surface water feature is the Ashton Canal approximately 50m to the south of the site.

Till is classified as a Secondary Undifferentiated Aquifer. The underlying bedrock is classified as a Secondary (B) Aquifer.

The site is not located within a Source Protection Zone (SPZ).

# 4. Existing Flood Risk

This section of the report identifies the existing risks from the different forms of flooding identified in NPPF.

## 4.1 Fluvial & Tidal Flooding

The EA has produced Flood Zone maps for much of England and Wales. The current displayed map is reproduced as Figure 2 below and shows the site to lie in Flood Zone 1 (low risk).

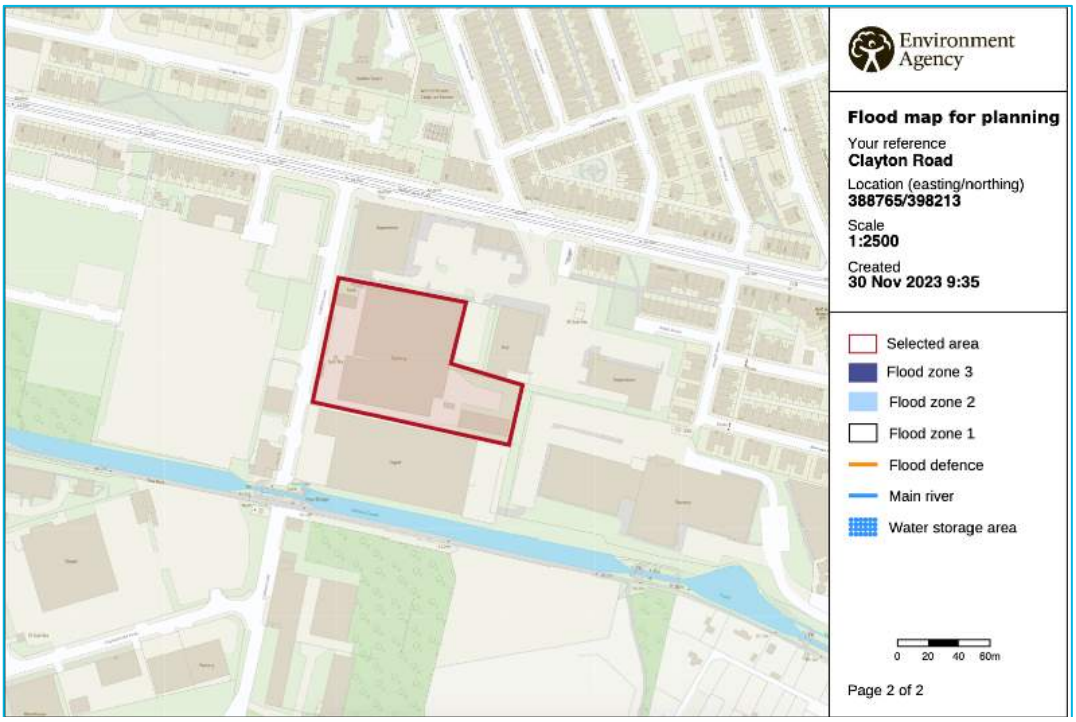



**Figure 2: EA Flood Map for Planning (Source: https://flood-map-for-planning.service.gov.uk/)**

On the coast storm surges and high tides can threaten low lying coastal areas and can be sometimes large and rapid enough to overtop defence works, causing significantly more damage than river flooding. Tidal flooding is not considered a risk to the site due to the inland location of the development.

Therefore, flood risk from fluvial and tidal sources to the site is considered to be low.

## 4.2 Surface Water Flooding

Surface water flooding occurs when rainfall is unable to infiltrate into the ground and/or inundates substandard engineered drainage networks and accumulates on the surface. This flooding mechanism can occur almost anywhere but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

The risk of flooding from surface water is presented in the GOV.UK online map at a strategic scale. It can be seen from the surface water flood map in Figure 3 that the site is shown to have an isolated area to the east at low risk of flooding. On review of the surveys (**Appendix A**) this is due to an un-drained low-lying area within the site.

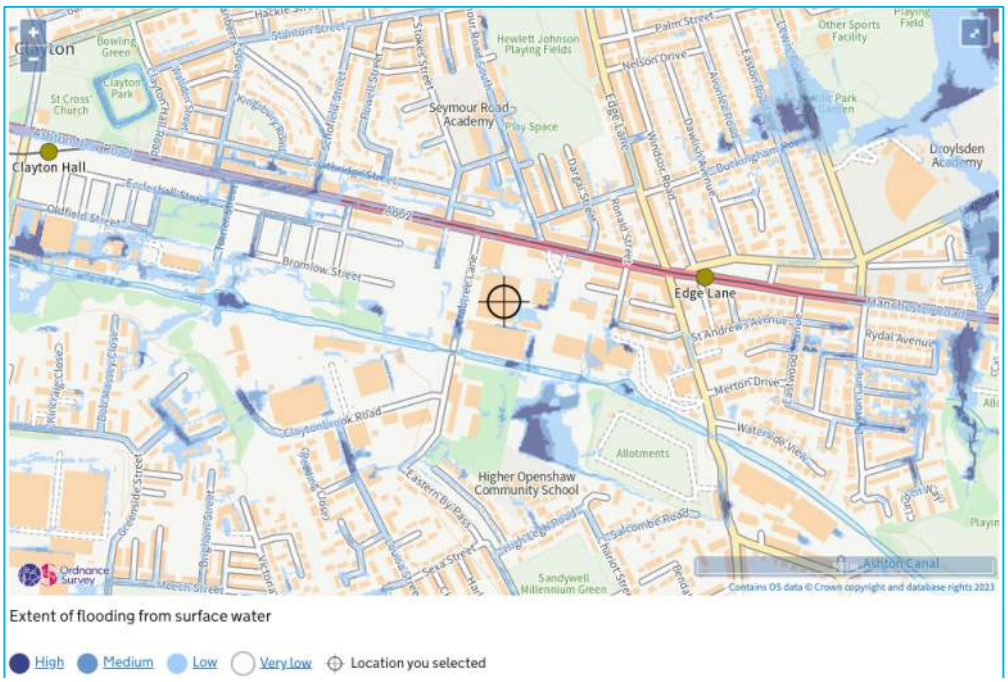



**Figure 3: Surface Water Flood Risk Map (Source: https://flood-warning-information.service.gov.uk)**

The surface water from the proposed development will provide a betterment to the existing case by capturing all surface water runoff from roofs and external hardstanding. Peak flows shall also be reduced thereby eliminating this surface water flooding. The site will therefore be at a low risk from surface water flooding.

### 4.3 Groundwater Flooding

The Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA includes a groundwater vulnerability map. The site is shown to be in an area outside of Groundwater flood risk.

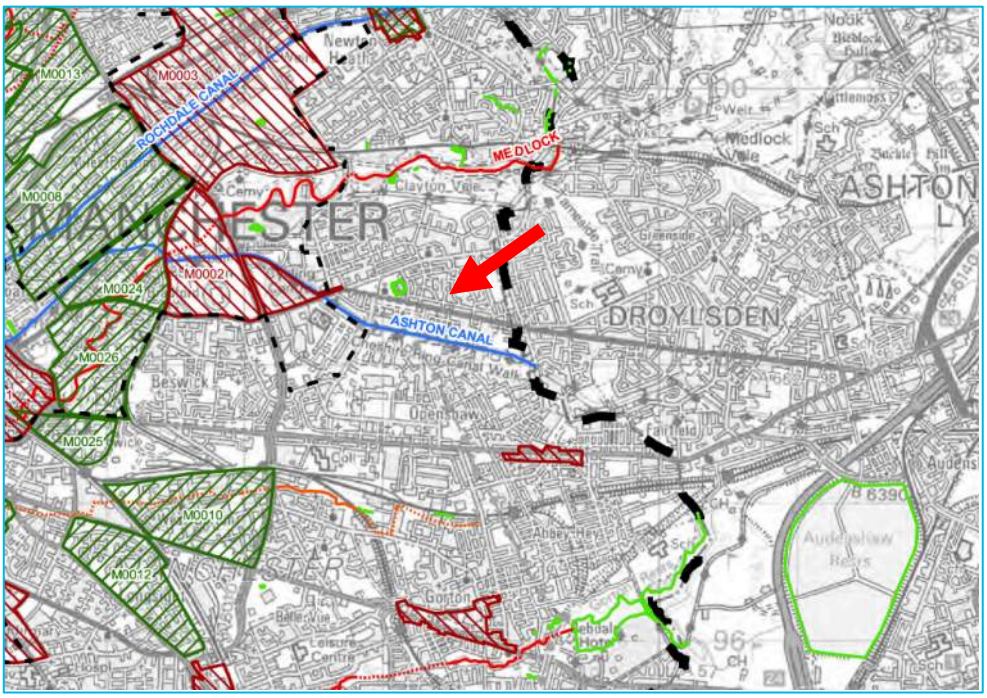



**Figure 4: Groundwater Flood Risk Map (Source: The Manchester City, Salford City and Trafford Councils Level 2 Hybrid)**

FFLs will also be set at least 150mm above existing ground levels. We would therefore expect the risk from groundwater flooding at this site to be low.

### 4.4 Sewer Flooding

A sewer flood is often caused by surface water drains discharging into the combined sewer systems. Sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes. Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30-year rainfall event. By definition a 1 in 100-year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

The site will have new separate surface and foul water networks up until the final connection into the existing public combined sewer. A non-return/backflow valve shall be placed at the downstream end of the foul network to prevent surcharge of the foul network. Surface water discharge from the site shall also be restricted therefore significantly improving the current situation.

Therefore, the risk of sewer flooding to the site is considered low.

### 4.5 Artificial Sources of Flooding

The EA Flood Risk from Reservoirs mapping indicates that the site is located outside of an area of potential risk from flooding. There has been no loss of life in the UK from reservoir flooding since 1925.

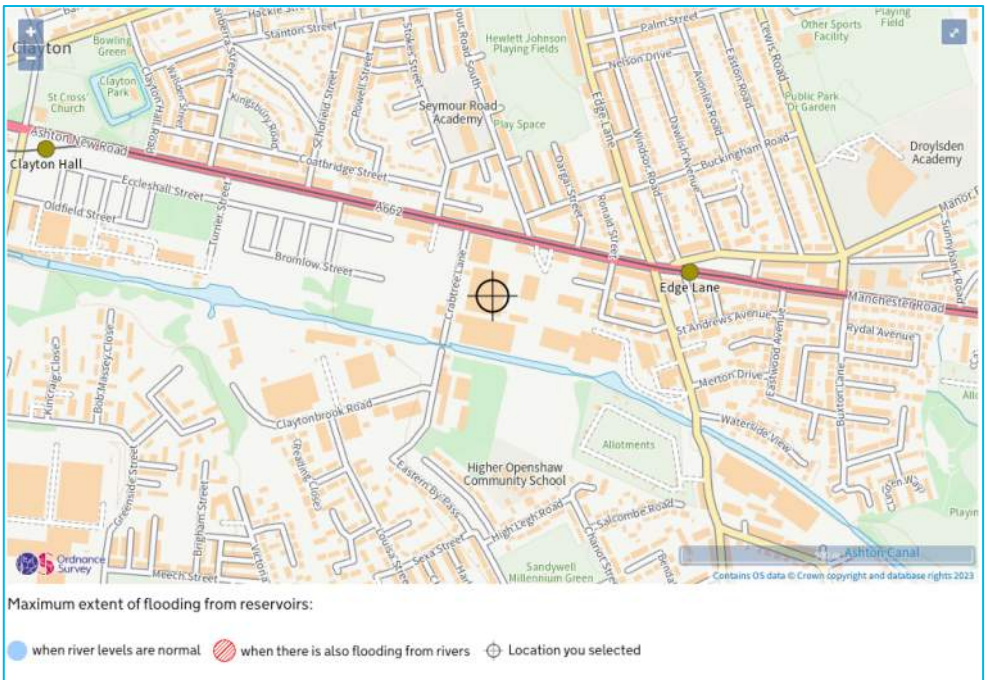



**Figure 5: Reservoir Flood Risk Map. (Source: https://flood-warning-information.service.gov.uk)**

Therefore, the risk from this type of flooding can be considered low.

### 4.6 Summary of Existing Flood Risk

The flood risk from fluvial & tidal flooding, surface water flooding, sewer flooding and groundwater is assessed to be low.

The flood risk to the site is summarised in Table 2.

**Table 2: Summary of flood risk to the Site**

| Type of Flooding | Source of Flooding | Existing Flood Risk |
|---|---|---|
| Fluvial and Tidal | River Medlock & Ashwater Canal | Low |
| Surface Water | Runoff from the site and surrounding land | Low |
| Sewers | Surrounding public drainage systems | Low |
| Ground Water | Underlying geology | Low |
| Artificial Sources | Reservoir | Low |

# 5. Flood Risk from the Proposed Development

The proposed development will consist of two blocks of terraced industrial units and a single industrial unit with associated parking and HGV turning areas. The total development site is generally flat with a total site area of 0.9Ha.

The proposed development drawing is included in **Appendix C**.

## 5.1 Fluvial and Tidal Flooding

The site is located within Flood Zone 1 and at low risk of fluvial flooding. The proposed development work would not have any impact on fluvial or tidal flooding. Therefore, the risk of flooding from fluvial and tidal sources has been assessed to remain low.

## 5.2 Surface Water Flooding

The existing site is 75% impermeable and the utility scan shows positive drainage points serving the existing site, see **Appendix A**. There is no existing surface water restriction in place for the existing impermeable portion of the site.

The surface water flood maps (Figure 3, above), shows the site is at low risk of localised surface water flooding due to an un-drained low-lying area within the site. The surface water from this development will provide a betterment to the existing case by capturing all surface water runoff from roofs and areas of external hardstanding. Peak flows shall also be reduced thereby eliminating surface water flooding.

## 5.3 Proposed Drainage Strategy

Discharge to ground. The site consists of Made Ground comprising gravel and sands to depths of 4m over Superficial deposits of Till comprising stiff clay. Due to the thickness of Made Ground and the cohesive nature of the superficial geology the subsoils are not conducive to infiltration.

Discharge to watercourse. The nearest surface water feature is the Ashton Canal approximately 50m to the south of the site. This option is not viable.

Discharge to sewer. A combined public sewer exists within the site and along Crabtree Lane to the west. Current discharge is to the public combined sewer.

Calculations have been undertaken to assess runoff rates for various storm durations for the existing impermeable 7,032m2 (0.7ha) site, see **Appendix E**. The proposed new development will be restricted to 50% reduction of the existing site 1yr 30min return period storm, thereby creating a significant betterment on the existing situation.

A comparison is provided in Table 3 below showing the percentage reduction in runoff rate proposed.

**Table 3: Existing/Proposed Surface Water Runoff reduction**

| Storm Event | Existing(l/s) | Proposed(l/s) | Reduction (%) |
|---|---|---|---|
| **Surface Water Runoff** | | | |
| 1yr Storm | 40.4 | 20.2 | 50% |
| 2yr Storm | 47.6 | 20.2 | 58% |
| 30yr storm | 90.9 | 20.2 | 78% |
| 100yr Storm | 118.6 | 20.2 | 83% |
| 100yr Storm + 45%CC | 172.0 | 20.2 | 88% |

As can be seen the proposed controlled runoff will equate to a 83% reduction from the existing scenario for the 100yr storm event. The drainage has been designed to accommodate all storms up to and including the 100yr event, including a 45% allowance for climate change. **Appendix D** shows the proposed drainage strategy, and the **Appendix E** shows the corresponding drainage calculations.

The surface water drainage network for the proposed development is in line with the principles of integrated Construction Industry Research and Information Association (CIRIA) Sustainable Drainage System SuDS and source control methods to convey surface water runoff flows from the site as well as national and local standard.

- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates. The existing site is 75% impermeable.
- The proposal is to limit the discharge from the redeveloped site to 50% reduction of the existing site 1yr 30min return period storm for all return periods, including climate change allowances.
- Appropriate attenuation to be provided onsite;
- The onsite surface water drainage design will follow the principles listed in the Approved Document Part H of the Building Regulations and Sewers for Adoption 7th Edition. The Building Regulations established a hierarchy for surface water disposal which encourages a SuDS approach;
- No surcharge for the 1:1year rainfall event except for the outfall pipe which may surcharge due to restriction.
- Onsite surface water sewers shall be designed to a 1 in 30 year no flooding standard in accordance with BS EN 752: 2017. There will be no flooding of buildings or off-site areas during a 1 in 100-year return period storm event including climate change allowance.
- Any onsite flooding in the 1:100+45% event, will be directed into a safe place or mitigation measures to be provided on site for any flooding over $5m^3$.

The proposed drainage network and attenuation requirements are modelled using industry standard hydraulic modelling software included in **Appendix E**. The controlled discharge will be made via the existing outfall of the site.

The proposed drainage layout is included in **Appendix D**.

Therefore, the risk of surface water flooding from the proposed development will remain low.

**Assessment of Surface Water Management Options**

For sustainable management of surface water run-off from a new development, the use of SuDS is recommended. Table 5 provides a comparison of the different kinds of SuDS systems and their suitability for use at the development site.

## 5.4 Water Quality

Table 26.2 of the CIRIA C753 SuDS Manual identifies that the pollution hazard level associated with the land uses within the Proposed Development as being 'Medium'. On a scale from 0 – 1, 'Commercial Yard & delivery areas' are deemed to have the following pollution hazard indices:

- Total suspended solids = 0.7
- Metals = 0.6
- Hydrocarbons = 0.7

The SuDS Manual confirms that in England and Wales, where the destination of runoff is to a watercourse then surface water indices should be used for the surface water discharge (Table 26.3 of The SuDS Manual).

The proposed surface water drainage strategy discharges to an existing outfall to an overflow ditch/watercourse. Therefore, the use of the surface water indices approach is deemed to be appropriate.

In terms of pollution control the site it is proposed that the commercial yard and delivery areas are to be protected by Class 1 bypass petrol interceptor. The pollution mitigation assessment is summarised in Table 4 below. The pollution removal characteristics of the pollution control features are based on data in CIRIA C753 and data provided by the product manufacturers.

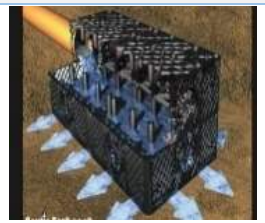
**Table 4: Pollution Mitigation Assessment for the site**

| Type of SuDS component | Total suspended solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|
| Class 1 Bypass Petrol Interceptor (Kingspan or similar) | 0.8* | 0.6* | 0.8* |
| **Total** | **0.4** | **0.6** | **0.8** |

*based on SPEL products

The results in Table 4 show that there is a minor residual impact associated with the Total Suspended Solids. However, whilst Pollution Mitigation Index data is not provided in CIRIA C753 for gullies/catch pit manholes, it is anticipated that sumps at the base of the gullies and catch pits will provide a positive improvement that would mitigate the residual impact for the Total Suspended Solids.

**Table 5: Assessment of Suitability of SuDS at the site as the drainage hierarchy**

| SUDS Group | Technique | Image | Description | Advantages | Disadvantages | Suitable for Use at Site |
|---|---|---|---|---|---|---|
| **Retention** | Balancing Pond | | Provides both storm water attenuation and treatment. Run-off from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation. | Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits. | No reduction in run-off volume, land take may limit use in high density sites. | ✗ Not feasible for proposed development |
| | Sub-surface Storage | | Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure. | Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas. | No water quality treatment. | ✓ Sub-surface storage is feasible and recommended. |
| **Wetland** | Shallow wetland<br>Extended detention wetland<br>Pond wetland<br>Pocket wetland<br>Submerged gravel wetland<br>Wetland channel | | Wetlands provide storm water attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detail flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits. | Good pollutant removal and if lined can be used where groundwater I vulnerable. Good community acceptability, ecological and amenity benefits. | Land take is high, requires base flow, little reduction in run-off volume, not suitable for steep sites. | ✗ Not feasible for proposed development |
| **Infiltration** | Infiltration trench<br>Infiltration basin<br>Soakaway |  | Surface water run-off can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated. | Reduces the volume of run-off, effective at pollutant removal, contributes to groundwater recharge, simple and cost-effective, easy performance observation. | Requires appropriate pre-treatment, basins require a large flat area, offset from foundations. | ✗ Subsoils not conducive to infiltration. |

| SUDS Group | Technique | Image | Description | Advantages | Disadvantages | Suitable for Use at Site |
|---|---|---|---|---|---|---|
| | Porous paving<br>Permeable paving | | Block or porous paving allows run-off to infiltrate through to subbase layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems. | Reduces the volume of run-off and if designed for infiltration contributes towards groundwater recharge. East to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive. | Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt. | × Parking areas are at risk of overrun by HGVs and/or are on gradients. |
| **Filtration** | Surface sand filter<br>Sub-surface sand filter<br>Perimeter sand filter | | Structures designed to treat surface water run-off through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of run-off is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required. | Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations. | Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2m required, possible odour problems, high capital and maintenance cost. | × Not feasible for proposed development |
| | Bioretention/filter swale | | Vegetated strips of land designed to accept run-off as overland sheet flow between a hard-surfaced area and a receiving system. | Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit, capability, effective pre-treatment option. | Requires landscaping and management, large land required, not suitable for steep sites; no significant attenuation or reduction of flows. | × Not feasible for proposed development |
| | Filter trench/drain | | Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water run-off. | Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit | High clogging potential without effective pre-treatment, limited to small catchments, | × Not feasible for the proposed development |

| SUDS Group | Technique | Image | Description | Advantages | Disadvantages | Suitable for Use at Site |
|---|---|---|---|---|---|---|
| | | | Receive lateral inflow from an adjacent impermeable surface. | well beside roads and car parks. | high cost of replacing filter material. | |
| **Detention** | Detention basin | | Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility | Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain. | Land take, little reduction in run-off volume, detention depths constrained by levels. | × Not feasible for proposed development |
| | Enhanced dry swale<br>Enhanced wet swale | | Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate. | Incorporate into landscaping, good removal of pollutants, reduces run-off rates and volumes, low cost. | Not suitable for steep areas, significant land take, not suitable in areas with roadside parking. | × Not feasible for proposed development |
| **Conveyance** | Conveyance swales<br>Rills | | Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate. | Negate the need for underground pipework. Can provide some attenuation. Possible reduction in run-off volume via plant uptake and infiltration. | Potential trip/wheel hazard, disable access issues. | × Not feasible for proposed development |
| **Source control** | Green/brown roof | | Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows. | Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption. | Additional weight, not appropriate for steep roofs, maintenance of roof vegetation. | × Not feasible for proposed development |

### 5.4.1 Maintenance of SuDS

The on-site drainage will be managed by the site management company who will be responsible to maintain any on-site services including drainage. The off-site private drainage is managed by a management company managing the business park.

**Table 6: Management and Maintenance Strategy**

| Drainage Feature | Regular Maintenance | Occasional/Remedial Maintenance | Monitoring |
|---|---|---|---|
| Drainage channels/Gullies | • Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent surfacing.<br>• Check for accumulation of debris and silt and cleaned as necessary<br>• Gratings, frames and all associated locking parts to be checked for damage.<br>• Exposed concrete and adjacent surfacing to be checked for cracking and general damage.<br>• Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures | • Channel/Slot cleaning will be by flushing with water or high-pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted.<br>• All channel surfaces and joints will be checked and repaired as necessary.<br>• Repair/rehabilitation of inlets, outlet, as required. | • Inspect every 4 months or after large storm. |
| Manholes/Inspection Chambers | • Check for accumulation of debris and silt and clean as necessary.<br>• Covers and frames to be checked for damage.<br>• Exposed concrete and adjacent surfacing to be checked for cracking and general damage.<br>• Check condition of inlet and outlet pipes, flap valves, baffles etc. | • Clean as necessary.<br>• All manhole and inspection chamber covers and frames to be replaced as necessary.<br>• Repair exposed concrete and surfacing as necessary<br>• Repair/rehabilitation of inlets, outlet, overflows and vents, as required. | • Inspect every 6 months or after large storm. |
| Attenuation Tank | • Check for accumulation of debris and silt and clean as necessary.<br>• Check condition of inlet and outlet pipes and ventilation structures | • Clean as necessary.<br>• Repair/rehabilitation of inlets and outlet, as required. | • Inspect every 6 months or after large storm. |

### 5.5 Sewer Flooding

The site will have new separate surface and foul water networks up until the final connection into the existing public combined sewer. A non-return/backflow valve shall be placed at the downstream end of the foul network to prevent surcharge of the foul network. Surface water discharge from the site will also be restricted therefore significantly improving the current situation.

Therefore, the risk of sewer flooding to the site post development work would remain unchanged.

### 5.6 Groundwater Flooding

The proposed development is likely to be constructed using PAD foundations and unlikely to impact the groundwater below the site.

Therefore, the risk from groundwater flooding will be remain as low.

### 5.7 Artificial Sources of Flooding

The proposed development work will not have an impact on artificial sources of flood risk.

### 5.8 Summary of Flood Risk from the Proposed Development

The flood risk to and from the proposed development has been assessed to remain low from all sources.

The flood risk to the development is summarised in Table 7.

**Table 7: Summary of flood risk to the development**

| Type of Flooding | Source of Flooding | Flood Risk | Proposed Mitigation |
|---|---|---|---|
| Fluvial and Tidal | River Medlock & Ashwater Canal | Low | Not required |
| Surface Water | Runoff from the site and surrounding land | Low | Proposed restriction to discharge rates which has a significant reduction on runoff rates and volumes from the site. |
| Sewers | Surrounding public combined drainage systems | Low | None |
| Ground Water | Underlying geology and groundwater levels | Low | Development levels raised. |
| Artificial Sources | none | Not applicable | |

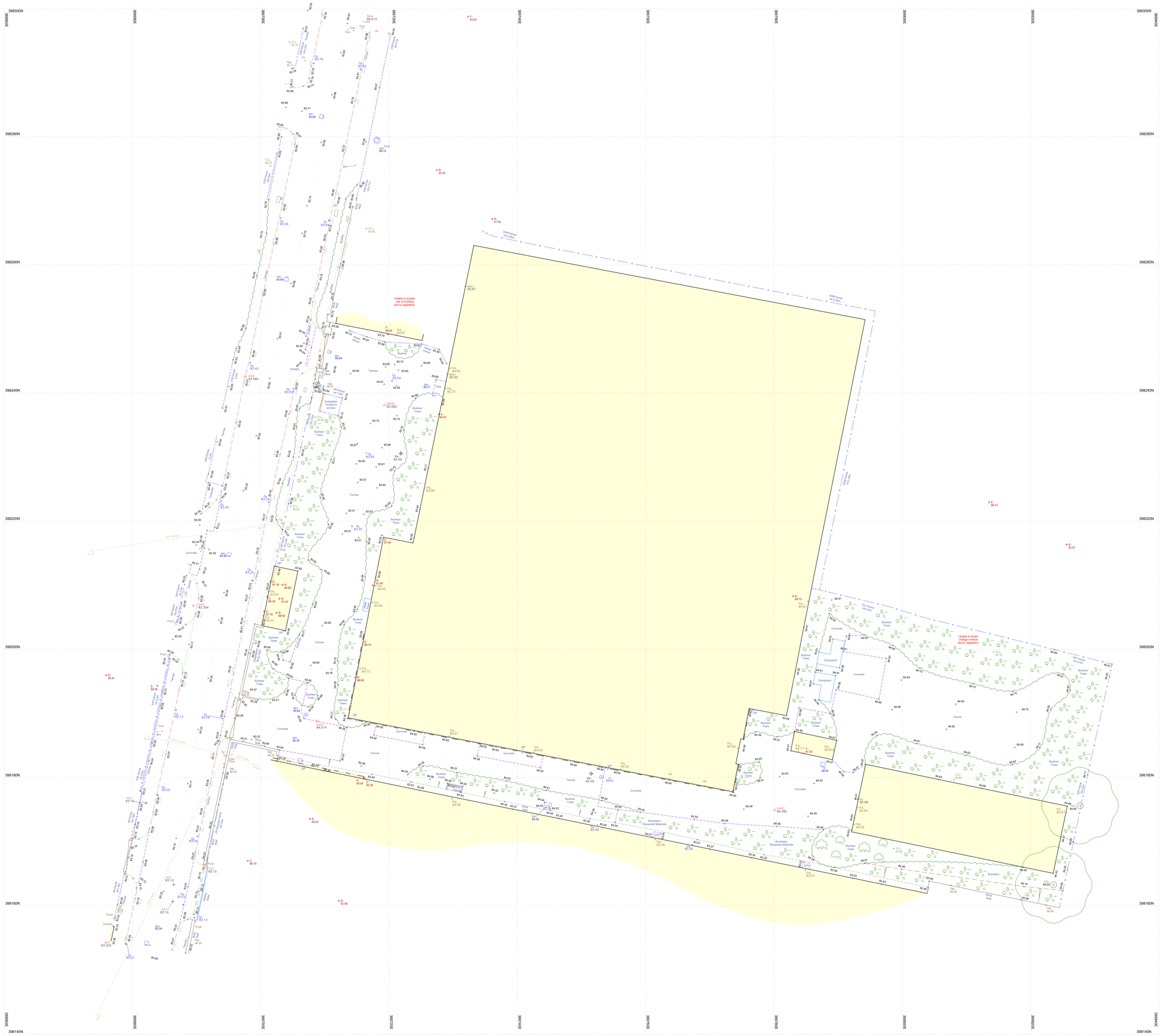
# 6. Conclusion

The existing flood risk to the development area from all sources has been assessed from a review of all available data. Future climate change has also been considered. Using the proposed development plan, the extent of the flood risk has been determined for the site as well as the effect that the development might have on flood risk elsewhere.

The assessment can be summarised as follows:

- The site is located in Flood Zone 1, low risk.
- The site is at low risk of flooding from all sources.
- The proposed development is classified as 'Less Vulnerable' and suitable for this location.
- The proposed development work would not increase the risk of flooding from any sources.
- The proposed development is outside of any area identified within Preliminary and Strategic FRAs for the City and surrounding areas.
- A drainage strategy is proposed in consideration with the local and national standard and would not increase the flood risk.
- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates. The existing site is 75% impermeable. The proposal is to limit the discharge from the redeveloped site to 50% reduction of the existing site 1yr 30min return period storm for all return periods, including climate change allowances.
- A geotechnical assessment by TRC has shown that due to the thickness of Made Ground and the cohesive nature of the superficial geology encountered during the investigations the subsoils would not be conducive to infiltration.
- In conclusion, the proposed development work will not increase the risk of flooding to the site or surrounding areas in accordance with the provisions of relevant national and local planning policies.

# Appendix A Topographical & Utility Survey Plans




N

## Station Information:

| Station | Easting (m) | Northing (m) | Level (m) |
|---|---|---|---|
| GH1 | 388678.984 | 398154.896 | 83.320 |
| GH2 | 388689.545 | 398206.816 | 83.394 |
| GH3 | 388697.594 | 398242.610 | 83.585 |
| GH4 | 388718.092 | 398296.441 | 84.012 |
| GH5 | 388719.135 | 398341.095 | 84.004 |
| GH30 | 388719.338 | 398238.092 | 83.680 |
| GH31 | 388708.842 | 398188.824 | 84.014 |
| GH32 | 388780.160 | 398174.967 | 84.482 |

*OS Note:*

*Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.*

*OS Buildings* *Surveyed Buildings*

*This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).*

*A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.*
*The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.*

*No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.*

*Please refer to Survey Station Table to enable establishment of the on-site grid and datum.*

## Legend:

Buildings, Wall, Kerb line, Line marking or tie or tie to, Drop kerb, Centre line, Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Unclass Channel, Verge, 100.000 Station and Name, Station Level, Tree / Bush / Sapling, Area of Undergrowth, Woodland, R. Ridge Level, E. Eaves Level, F. Flat Roof Level, TWL Top of Wall Level, Gate, Interwoven, Iron Railings, Wire Mesh, Post & Rail, Post & Wire, Chain Link, Wooden Panels, Concrete Panels, Steel Panels

Fence types: IW, IR, WM, PR, PW, CL, WP, CP, SP

| | | | | | |
|---|---|---|---|---|---|
| IC | Inspection chamber | Bo. | Bollard | | |
| Pipe | Pipe invert | IS | Illuminated bollard | | |
| Gy | Gully | Bin | Rubbish bin | | |
| Bg | Back gully | Vp | Vent pipe | | |
| Gp | Down pipe | GR | Ground light | | |
| Pipe | Pipe above ground | Llox | Letter box | | |
| MH | Manhole | Ld | Ladder | | |
| WL | Water level | Sly | Silo | | |
| Fl | Flood light | FL | Internal floor level | | |
| Lp | Lamp post | THL | Threshold level | | |
| Tp | Telegraph pole | Sp | Sign post | | |
| Ep | Electricity post | Tw | Trashcan | | |
| Tl | Traffic light | BH | Bollards | | |
| Bus | Bus stop | ELC | Electric | | |
| Sv | Stop valve | BT | British Telecom | | |
| St | Stop tap | Ctrm | Control box | | |
| Er | Earth rod | TT | Tactile | | |
| Wm | Water meter | BP | Brick paved | | |
| Gas | Gas valve | CPS | Concrete paving slab | | |
| Av | Air valve | CVR | Cover | | |
| ICU | Underdrilled inspection | IC | Inspection chamber | | |
| Wo | Wash out | Rwall | Retaining wall | | |
| Re | Rodding eye | UTR | Unable to raise | | |
| BB | Beltelite beacon | TCL | Tree canopy level | | |
| CTV | Cable tv | G | Grille | | |
| Mk | Marker post | MG | Multi grith | | |
| Gmkr | Gas marker post | Stmp | Tree Stump | | |
| So | Soffit | CL | Cover level | | |
| | | IL | Invert level | | |

| Rev | Date | Description | Drawn | Ch. Rev |
|---|---|---|---|---|
| | | | | |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- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
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CLIENT
**Chancerygate**

PROJECT
**Former Walkers Site**
**Crabtree Lane**
**Manchester, M11 4GU**

TITLE
**Topographical Survey**

| SCALE | DATE |
|---|---|
| A0@ 1: 200 | 12.05.23 |
| DRAWN | QUALITY REF |
| MT | GH16975 |

| | |
|---|---|
| Level datum | See notes |
| Grid orientation | See notes |
| Job number | 47333 |
| Drawing No. | Rev. |
| 47333_T | 0 |

Comments
*This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.*

*All dimensions should be checked on site prior to design and construction.*

*Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.*

Notes:

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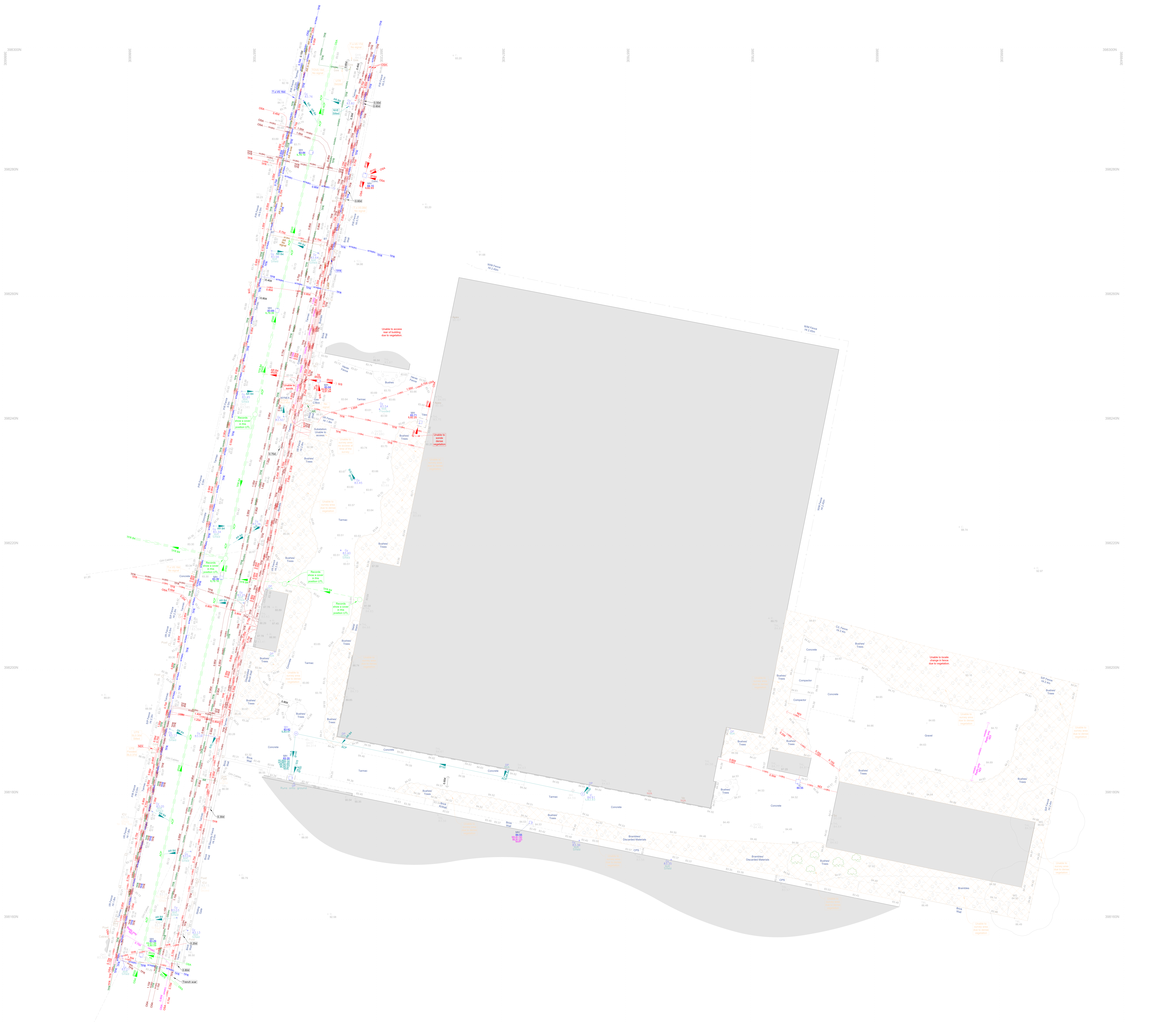


N

NOTES;

In all cases please call the BT Dial before you dig service to mark their own plant before any site works commence
0800 917 3993
Always consult utility plans

1. Drainage Information provided has been determined without man entry into the chambers. Whilst every effort has been made to correctly identify the duty/pipes/chamber detail, it is recommended that this information should be checked in areas that are critical to the future proposal/development.
2. All sewer runs are presumed to be straight line connections between chambers unless proven otherwise by the use of a sonde or CCTV survey.
3. All desktop information should be treated as historical as the buried assets present might have changed since the drawing/record was last updated.
4. Some of the areas were unable to survey fully due to dense vegetation, we recommend cutting this down if more clarity is needed.
5. Some of the services have been taken from records due to being unable to locate them using geophysical equipment.

## UTILITY LINETYPES

| | |
|---|---|
| Air Line | Electric Low Voltage |
| British Telecom | Electric High Voltage |
| British Telecom Overhead | Electric - Unknown Voltage |
| CCTV / Cable Television | Electric Overhead |
| Communication Cable | Fibre Optic |
| Drainage - Combined Water | Fuel Line |
| Drainage - Foul Water | Gas Line |
| Drainage - Storm Water | Gauge Line |
| Drainage - Unknown Water | GPR Line |
| Drainage - Trade Effluent Water | Heating Pipes |
| Drainage - Combined Water - Assumed/TFR | Offset Fills |
| Drainage - Foul Water - Assumed/TFR | Oil Pipe |
| Drainage - Storm Water - Assumed/TFR | Rising Main |
| Drainage - Unknown Water - Assumed/TFR | Telecom |
| Drainage - Trade Effluent Water - Assumed/TFR | Traffic Light Signals |
| Drainage - Approximate Pipe Size/Extents | Trench Scar |
| Earth Cable | Unknown |
| Empty Duct | Vapour Recovery |
| Electric & Comms | Vent Line |
| | Water |

## UTILITY SURVEY INFORMATION

| | | | |
|---|---|---|---|
| Contracted Survey Area | | Assumed Route | AR |
| Depth to Top of Service (m) | 0.40d | Assumed Connection | ACP |
| End of Trace | EOT | Sound Connection | S/C |
| Head of Run | HoR | Sonde Stopped | S/S |
| Weak Signal | WS | No Visible Access | NVA |
| Taken From Records | TFR | No Visible Exit | NVE |
| Off Survey Area | OSA | No Visible Pipes | NVP |
| Back Drop | BD | No Visible Services | NVS |
| Silt Level | SL | No Depth Indicated | NDI |
| Above Ground | A/G | Base Level | BL |
| Unable to Locate | UTL | High Level | HL |
| Unable to Survey | UTS | Top of Pipe / Top of Valve | T.o.P / T.o.V |
| Unable to Raise (cover) | UTR | Landing Level | LL |
| Unable to Trace | UTT | Rubble Level | RL |
| Unable to Survey | | Approximate Location | |
| | | GPR Anomaly | |
| Chamber Extents | | Multiple Services Route | |

## LEGEND

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Buildings | Overhead Cable | IC | Inspection chamber | Bo | Bollard | | |
| Wall | Concrete edge | PInv | Pipe invert | IB | Illuminated bollard | | |
| Kerb line | Tarmac edge | Gy | Gully | Bin | Rubbish bin | | |
| Line marking | Grass verge | Bg | Back gully | Vp | Vent pipe | | |
| Drop kerb | Canopy/Overhang | Dp | Down pipe | Grl | Ground light | | |
| Centre line | Verge | Pipe | Pipe above ground | Lbox | Letter box | | |
| Top of bank | Bottom of bank | MH | Manhole | Stmp | Tree Stump | | |
| | Station and Name | WL | Water level | Sty | Stile | | |
| 100.000 | Station Level | Fl | Flood light | IFL | Internal floor level | | |
| | | Lp | Lamp post | THL | Threshold level | | |
| | Tree / Bush / Sapling | Tp | Telegraph post | Sp | Sign post | | |
| | Area of Undergrowth | Ep | Electricity post | TH | Trialhole | | |
| | Woodland | Tl | Traffic light | BH | Borehole | | |
| R: | Ridge Level | Bus | Bus stop | ELC | Electric | | |
| E: | Eaves Level | Sv | Stop valve | BT | British Telecom | | |
| F: | Flat Roof Level | St | Stop tap | C'box | Control box | | |
| | Gate | Er | Earth rod | TT | Tactile | | |
| Fence types: | | Wm | Water meter | BP | Brick paved | | |
| I\W | Interwoven | Gas | Gas valve | CPS | Concrete paving slabs | | |
| I\R | Iron Railings | Av | Air valve | CVR | Cover | | |
| W\M | Wire Mesh | ICU | Unidentified inspection | R/wall | Retaining wall | | |
| P\R | Post & Rail | Wo | Wash out | TWL | Top of Wall Level | | |
| P\W | Post & Wire | Re | Rodding eye | TCL | Tree canopy level | | |
| C\L | Chain Link | BB | Belisha beacon | G: | Girth | | |
| W\P | Wooden Panels | CTV | Cable tv | MG | Multi girth | | |
| C\B | Close Boarded | Mkr | Marker post | IC | Inspection chamber | | |
| S\P | Steel Palisade | Gmkr | Gas marker post | CL: | Cover level | | |
| | | So | Soffit | IL: | Invert level | | |
| | | Fh | Fire hydrant | UTL | Unable to locate | | |

## PAS 128 : 2022 LEVEL B SURVEY

| QUALITY LEVEL | CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL | LOCATION ACCURACY |
|---|---|---|
| QL-B4 | A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST (EITHER ON QL-D OR QL-C) BUT HAS NOT BEEN DETECTED AND THEREFORE SHOWN AS AN ASSUMED ROUTE. **(NO DETECTION POSSIBLE)** | **UNDEFINED** |
| QL-B3/B3P | HORIZONTAL LOCATION ONLY OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES USED. **(EML OR GPR DETECTION WITH LIMITED CONFIDENCE IN DEPTH)** | **+/- 500mm HORIZONTAL LOCATE UNDEFINED VERTICAL LOCATE** |
| QL-B2/B2P | HORIZONTAL & VERTICAL LOCATION OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. **(EML OR GPR DETECTION WITH CONFIDENCE IN DEPTH)** | **+/- 250mm HORIZONTAL LOCATE +/- 40% VERTICAL LOCATE** |
| QL-B1/B1P | POSITION AND DEPTH OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES. **(EML + GPR DETECTION)** | **+/- 150mm HORIZONTAL LOCATE +/- 15% VERTICAL LOCATE** |

## DISCLAIMER

*Whilst every effort has been taken in the preparation of this drawing, the original land marks/apparatus configuration may have been altered since the survey/drawing was produced. The user shall make further enquiries and investigations to satisfy himself as to the accuracy of this drawing and position of the apparatus. The exact positions of the apparatus should be verified by the use of suitable detection devices and safe digging practices in accordance with HSG47, further advice on the location of apparatus should be recommended by the owner. No representation is made by Greenhatch Group, its agents or servants as to the accuracy, completeness, and sufficiency or otherwise of this drawing and the position of the apparatus.*

*All apparatus shall be treated as live unless proved otherwise by the owner. It is the users responsibility to ensure that the information on the location of apparatus is provided to all persons (either direct labour or contractors) working in proximity to the apparatus.*

| Rev | Date | Description | Drawn | Q. Ref. |
|---|---|---|---|---|
| | | | | |

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CLIENT
**Chancerygate**

PROJECT
**Former Walkers Site**
**Crabtree Lane**
**Manchester, M11 4GU**

TITLE
**Utilities Survey**

| SCALE | DATE |
|---|---|
| A0@ 1: 200 | 24/05/2023 |
| DRAWN | QUALITY REF |
| KS,MAB | |

| | |
|---|---|
| Level datum | See notes |
| Grid orientation | See notes |
| Job number | 47333 |

| Drawing No. | Rev. |
|---|---|
| 47333_T_UG | 0 |

Comments
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*Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.*

Notes:

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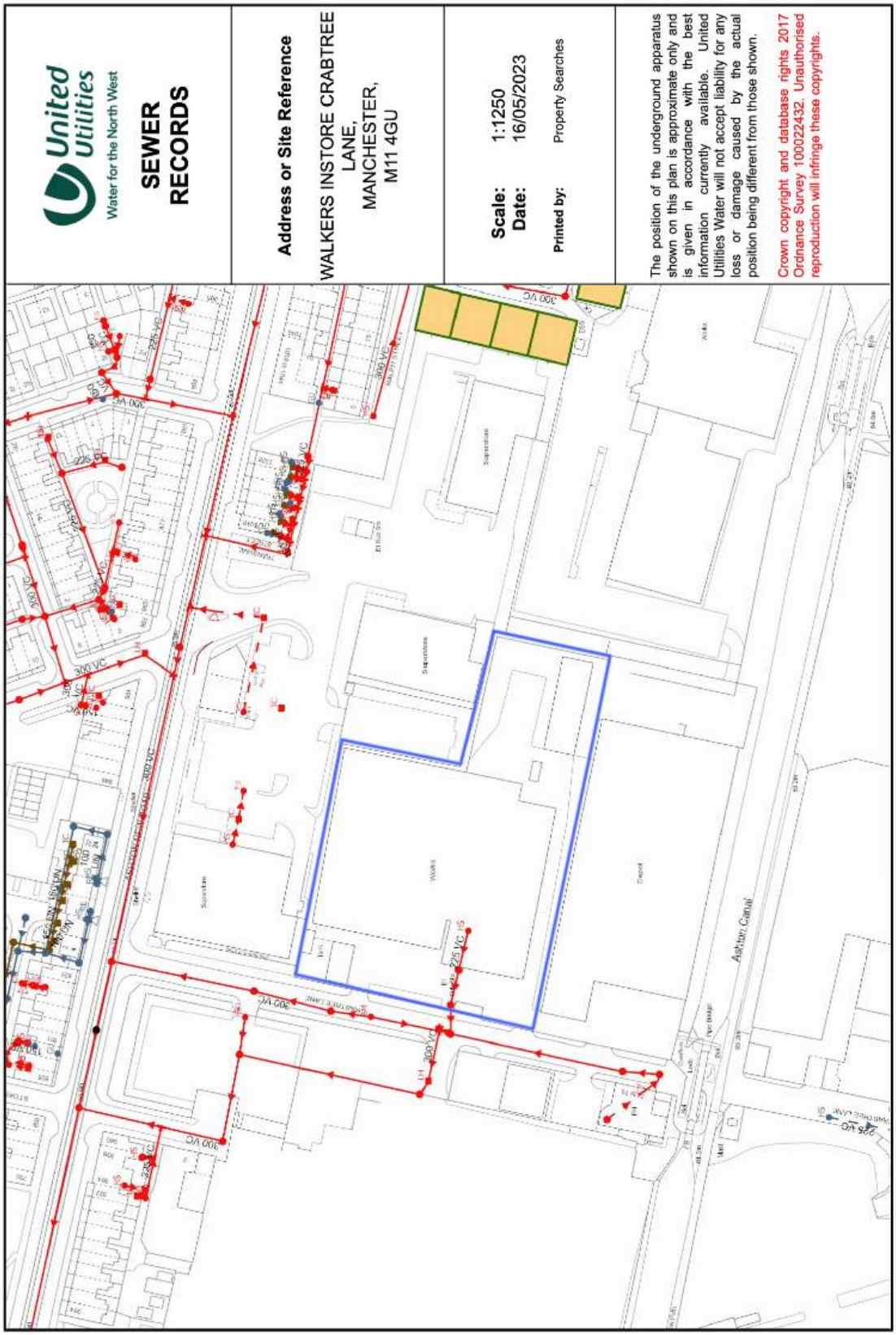
# UTILITY LINETYPES

| | |
|---|---|
| Air Line | AIR |
| British Telecom | BT |
| British Telecom Overhead | O/H |
| CCTV / Cable Television | TV |
| Communication Cable | COM |
| Drainage - Combined Water | Ø150 |
| Drainage - Foul Water | Ø150 |
| Drainage - Storm Water | Ø150 |
| Drainage - Unknown Water | Ø150 |
| Drainage - Trade Effluent Water | Ø150 |
| Drainage - Combined Water - Assumed/TFR | Ø150 |
| Drainage - Foul Water - Assumed/TFR | Ø150 |
| Drainage - Storm Water - Assumed/TFR | Ø150 |
| Drainage - Unknown Water - Assumed/TFR | Ø150 |
| Drainage - Trade Effluent Water - Assumed/TFR | Ø150 |
| Drainage - Approximate Pipe Size/Extents | |
| Earth Cable | ETH |
| Empty Duct | ED |
| Electric & Comms | E&C |
| Electric Low Voltage | LV |
| Electric High Voltage | HV |
| Electric - Unknown Voltage | E |
| Electric Overhead | O/H |
| Fibre Optic | FO |
| Fuel Line | FL |
| Gas Line | GAS |
| Gauge Line | GL |
| GPR Line | GPR |
| Heating Pipes | HTG |
| Offset Fills | OF |
| Oil Pipe | OIL |
| Rising Main | >> |
| Telecom | TEL |
| Traffic Light Signals | TL |
| Trench Scar | |
| Unknown | UKN |
| Vapour Recovery | VR |
| Vent Line | VP |
| Water | WTR |

# UTILITY SURVEY INFORMATION

| | |
|---|---|
| Contracted Survey Area | SVY AREA |
| Depth to Top of Service (m) | 0.40d |
| End of Trace | EOT |
| Head of Run | HoR |
| Weak Signal | WS |
| Taken From Records | TFR |
| Off Survey Area | OSA |
| Back Drop | BD |
| Silt Level | SL |
| Above Ground | A/G |
| Unable to Locate | UTL |
| Unable to Survey | UTS |
| Unable to Raise (cover) | UTR |
| Unable to Trace | UTT |
| Unable to Survey | |
| Chamber Extents | |
| Assumed Route | AR |
| Assumed Connection | ACP |
| Sound Connection | S/C |
| Sonde Stopped | S/S |
| No Visible Access | NVA |
| No Visible Exit | NVE |
| No Visible Pipes | NVP |
| No Visible Services | NVS |
| No Depth Indicated | NDI |
| Base Level | BL |
| High Level | HL |
| Top of Pipe / Top of Valve | T.o.P / T.o.V |
| Landing Level | LL |
| Rubble Level | RL |
| Approximate Location | |
| GPR Anomaly | |
| Multiple Services Route | |

# Appendix B United Utility Public Sewer Map



# Appendix C Proposed Development Plan

Proposed Site Plan

Scale 1:250

- Dimensions are in millimeters, unless stated otherwise.
- Scaling of this drawing is not recommended.
- It is the recipients responsibility to print this document to the correct scale.
- All relevant drawings and specifications should be read in conjunction with this drawing.

N

**Site Boundary**
2.27 acres (0.9200 ha)

**KEY**

- 9 Level Access Doors
- Electric Charging Spaces x18
  All remaining spaces to be future proofed for 100%
- Grass roof Cycle Shelter for 14 Cycles
  Each unit contains 2 internal cycle spaces (18 Cycles)
  OVERALL 32 Cycle space provision
- Existing 2.4m High Metal Palisade Fence (Colour black)
- Proposed 2.4m High Metal Paladin Fence (Colour black)
- Pedestrian and Vehicle gates in 2.4m high paladin style (Colour black)
- Retractable/drop down bollards 900mm high
- Indicative retaining wall position
  Where required retaining walls will have key clamp guarding to the top to prevent falls.
- Private Means of Access - No works in this area.

58 no. Car parking spaces (inc. 9 accessible)

**Schedule of Accommodation Units 1-4**

| | GIA | | GEA | | Mezz % |
|---|---|---|---|---|---|
| | sq.m | sq.ft | sq.m | sq.ft | |
| **UNIT 1** | | | | | |
| Warehouse | 537.5 | 5785.7 | 582.0 | 6264.6 | |
| GF Recessed Loading | 42.0 | 452.1 | 45.0 | 484.4 | |
| Mezz | 179.0 | 1926.7 | 196.0 | 2109.7 | |
| **Total** | **758.6** | **8165.5** | **823.0** | **8858.7** | **24%** |
| **UNIT 2** | | | | | |
| Warehouse | 390.5 | 4203.3 | 416.6 | 4484.2 | |
| GF Recessed Loading | 42.0 | 452.1 | 45.0 | 484.4 | |
| Mezz | 134.0 | 1442.4 | 144.0 | 1550.0 | |
| **Total** | **566.5** | **6097.7** | **605.6** | **6518.6** | **24%** |
| **UNIT 3** | | | | | |
| Warehouse | 350.0 | 3767.4 | 370.0 | 3982.6 | |
| Mezz | 105.0 | 1130.2 | 116.0 | 1248.6 | |
| **Total** | **455.0** | **4897.6** | **486.0** | **5231.3** | **23%** |
| **UNIT 4** | | | | | |
| Warehouse | 412.0 | 4434.7 | 444.0 | 4779.2 | |
| Mezz | 123.0 | 1324.0 | 139.0 | 1496.2 | |
| **Total** | **535.0** | **5758.7** | **583.0** | **6275.4** | **23%** |
| **GRAND TOTAL** | **2315.1** | **24919.6** | **2497.6** | **26883.9** | |

**Schedule of Accommodation Unit 5**

| | GIA | | GEA | | Mezz % |
|---|---|---|---|---|---|
| | sq.m | sq.ft | sq.m | sq.ft | |
| **UNIT 5** | | | | | |
| Warehouse | 992.0 | 10677.8 | 1055.0 | 11355.9 | |
| Mezz | 244.0 | 2626.4 | 273.0 | 2938.5 | |
| **GRAND TOTAL** | **1236.0** | **13304.2** | **1328.0** | **14294.5** | **20%** |

**Schedule of Accommodation Units 6-9**

| | GIA | | GEA | | Mezz % |
|---|---|---|---|---|---|
| | sq.m | sq.ft | sq.m | sq.ft | |
| **UNIT 6** | | | | | |
| Warehouse | 328.0 | 3530.6 | 359.0 | 3864.2 | |
| Mezz | 126.0 | 1356.3 | 140.0 | 1506.9 | |
| **Total** | **454.0** | **4886.8** | **499.0** | **5371.2** | **28%** |
| **UNIT 7** | | | | | |
| Warehouse | 269.0 | 2895.5 | 287.0 | 3089.2 | |
| Mezz | 103.0 | 1108.7 | 112.0 | 1205.6 | |
| **Total** | **372.0** | **4004.2** | **399.0** | **4294.8** | **28%** |
| **UNIT 8** | | | | | |
| Warehouse | 269.0 | 2895.5 | 287.0 | 3089.2 | |
| Mezz | 103.0 | 1108.7 | 112.0 | 1205.6 | |
| **Total** | **372.0** | **4004.2** | **399.0** | **4294.8** | **28%** |
| **UNIT 9** | | | | | |
| Warehouse | 271.0 | 2917.0 | 297.0 | 3196.5 | |
| Mezz | 104.0 | 1119.4 | 116.0 | 1248.6 | |
| **Total** | **375.0** | **4036.5** | **413.0** | **4445.5** | **28%** |
| **GRAND TOTAL** | **1573.0** | **16931.6** | **1710.0** | **18406.3** | |

**Schedule of Accommodation TOTAL**

| | GIA | | GEA | |
|---|---|---|---|---|
| **OVERALL TOTAL** | **5,124.1** | **55,155.3** | **5,535.6** | **59,584.6** |

| rev | amendments | by | ckd | date |
|---|---|---|---|---|
| P.04 | Rear boundary revised to suit features. | JC | JC | 15.12.23 |
| P.03 | Fences revised, easement zone added. | JC | JC | 23.11.23 |
| P.02 | Table of areas added. | JC | JC | 14.11.23 |
| P.01 | Initial Issue | JC | JC | 02.11.23 |

# Former Walkers Site, Crabtree Lane, Manchester

## Proposed Site Plan

| Information Container LOD: | LOD 100 |
|---|---|

Chancerygate

umc architects

Newark Beacon, Cafferata Way, Newark, Nottinghamshire NG24 2TN
o: +44 (0)1636 653027 e: info@umcarchitects.com

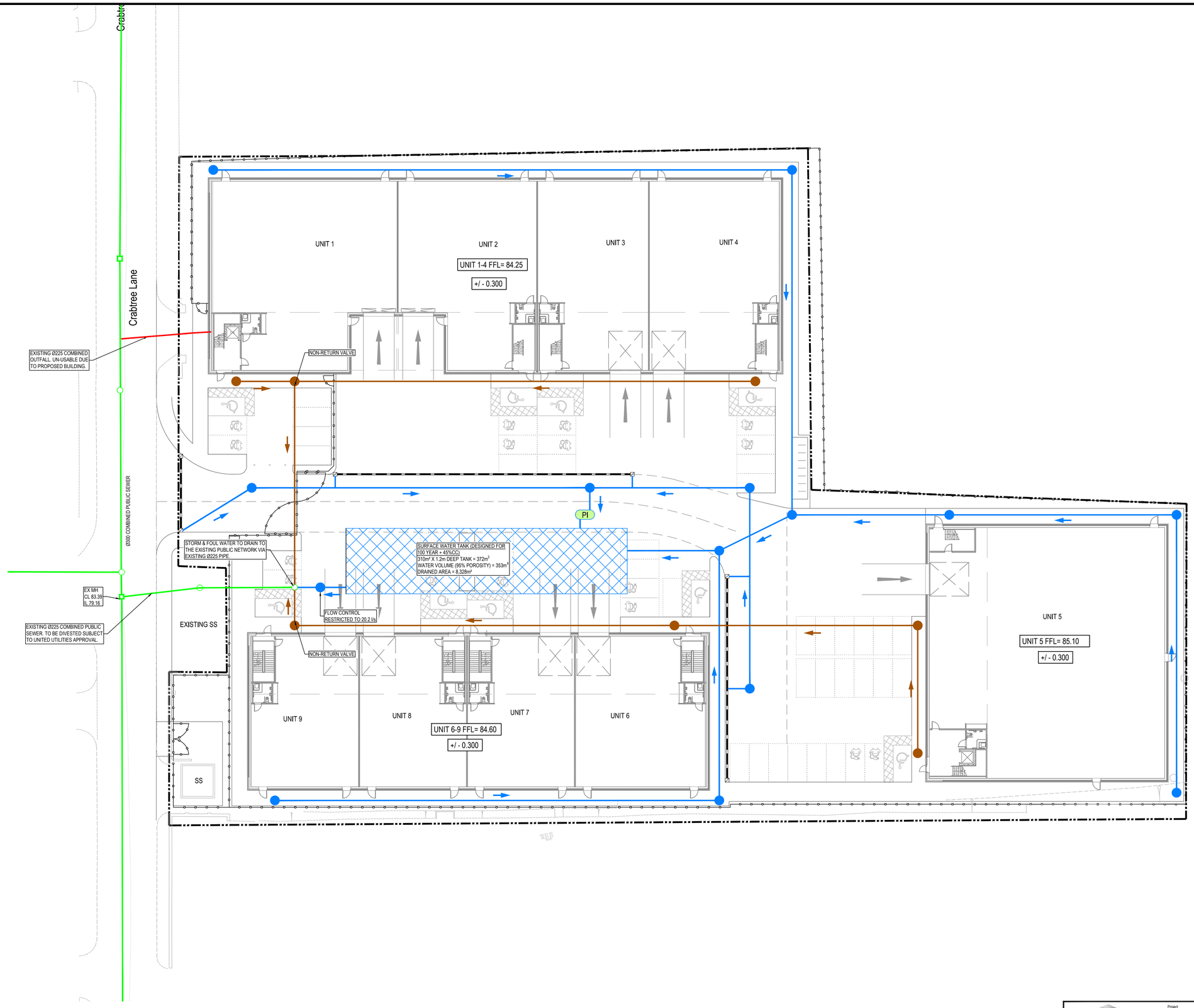
PLANNING

THIS DRAWING IS TO BE USED FOR THE STATED PURPOSE ONLY AND SHOULD NOT BE USED FOR ANY OTHER

| | |
|---|---|
| RIBA PoW Stage: | 3 - Spatial Coordination |
| Document Suitability: | S1 |
| Drawn / Checked: | JWC / JC |
| Date: | 02/11/2023 |
| Scale: | 1:250 A1 |
| UMC Project Number: | 23168 |
| Document Reference: | Drawing no: / Revision: |
| 23168 - UMC - XXXX - SI - DR - A | 0601 / P04 |

5m SCALE 1:250

# Appendix D Proposed Drainage Strategy Layout




## STRATEGY

1. THIS DRAWING SHOULD ONLY USED TO SUPPORT A PLANNING APPLICATION AND MAY FORM PART OF A FLOOD RISK ASSESSMENT. IT FORMS AN INTENDED STRATEGY THAT WILL BE DEVELOPED IN MORE DETAIL.

2. DO NOT USE THIS DRAWING FOR DETAILED COST ESTIMATES OR TENDER PURPOSES.

PRE-DEVELOPMENT:

3. THE EXISTING SITE IS PRE-DEVELOPED AND DISCHARGES INTO A PUBLIC COMBINED SEWER VIA 1NO. Ø225mm PIPE.

PROPOSAL:

4. THE NEW DEVELOPMENT SHALL BE RESTRICTED TO 20.2l/s. THIS IS BASED ON 50% REDUCTION OF THE EXISTING M1-30 STORM EVENT.

5. TOTAL ATTENUATION FOR 100Yr+45% CLIMATE CHANGE STORM EVENT STORED BELOW GROUND = 353m³.

HYDRAULIC DESIGN:

6. THE SURFACE WATER NETWORK, FLOW CONTROL AND ATTENUATION HAS BEEN DESIGNED USING MICRODRAINAGE SOFTWARE WITH FSR RAINFALL DATA.

FINAL DRAINAGE CONNECTIONS:

7. DISCHARGE POINTS SHOWN MAY NEED TO BE FURTHER INVESTIGATED IN TERMS OF LOCATING AND INVERT LEVELS.

8. APPROVAL SHALL BE OBTAINED FOR INTENDED DISCHARGE INTO THE PUBLIC SEWER.

MAINTENANCE:

9. THE NETWORK AND ALL ANCILLARY COMPONENTS SHALL RECEIVE REGULAR MAINTENANCE AS OUTLINED IN SEPARATE SCHEDULE.

AREAS:

| | |
|---|---|
| SITE AREA | 0.910 ha |
| EXISTING IMPERMEABLE AREA | 0.703 ha |
| PROPOSED IMPERMEABLE AREA | 0.839 ha |

## LEGEND

- SITE BOUNDARY (0.91ha)
- EXISTING COMBINED PUBLIC SEWER
- NEW STORM WATER RUN
- NEW FOUL WATER RUN
- PI — PETROL INTERCEPTOR SERVICE YARD AND OTHER VEHICULAR ACCESSED AREAS TO PASS THROUGH PETROL INTERCEPTOR BEFORE DRAINING TO TANK.

| Rev. | Date | Description | Technician | Reviewer |
|---|---|---|---|---|
| P1 | 12.12.23 | PRELIMINARY ISSUE | RM | IL |

N

I&L CONSULTING Ltd

projects@i-consultants.com

| Project | Drawing |
|---|---|
| CRABTREE LANE<br>CLAYTON | DRAINAGE PLANNING STRATEGY |

| Drawing Set | Drawing Status | Scale | Project Number | Drawing Number | Revision |
|---|---|---|---|---|---|
| DRAINAGE | PRELIMINARY | 1:250 @ A1<br>1:500 @ A3 | 23-026-I&L | D00 | P1 |

# Appendix E Hydraulic Calculations

**Crabtree Lane,Clayton - Existing Site Runoff Calculation**

***Date:*** 11-Dec-23
***By:*** SH

I&L CONSULTING Ltd

**DESIGN PARAMETERS**

| | | |
|---|---|---|
| Total Site Area | 9,103 | $m^2$ |
| Roof & Externals | 7,032 | $m^2$ |
| Existing Permeable | 2,071 | $m^2$ |
| Total Impermeable area | **7,032** | $m^2$ |
| Runoff Coefficient | 95% | *assuming no loss to depression storage* |

**RAINFALL**

In accordance with 'Design and analysis of Urban Storm Drainage – Wallingford Procedure Volume 4 – The Modified Rational Method'.

UK Sustainable Drainage Tool M5-60 =

20 mm — Figure A.1 *(vol. 4 Modified Rational Method)*

r = 0.42 — Figure A.2 *(vol. 4 Modified Rational Method)*

| Storm | Z1 | Rainfall (mm) |
|---|---|---|
| M5-5 | 0.39 | 8 |
| M5-10 | 0.53 | 11 |
| M5-15 | 0.65 | 13 |
| M5-30 | 0.8 | 16 |
| M5-60 | 1 | 20 |
| M5-120 | 1.2 | 24 |
| M5-240 | 1.4 | 28 |
| M5-360 | 1.6 | 32 |
| M5-600 | 1.8 | 36 |
| M5-1440 | 2.2 | 44 |

| Storm | Z2 | Rainfall (mm) | Rainfall Intensity (mm/hr) | Qmax (L/s) | Volume (m3) |
|---|---|---|---|---|---|
| M1-5 | 0.62 | 5 | 58.0 | 107.7 | 32.3 |
| M1-10 | 0.61 | 6 | 38.8 | 72.0 | 43.2 |
| M1-15 | 0.62 | 8 | 32.2 | 59.8 | 53.8 |
| M1-30 | 0.68 | 11 | 21.8 | 40.4 | 72.7 |
| M1-60 | 0.72 | 14 | 14.4 | 26.7 | 96.2 |
| M1-120 | 0.78 | 19 | 9.4 | 17.4 | 125.1 |
| M1-240 | 0.78 | 22 | 5.5 | 10.1 | 145.9 |
| M1-360 | 0.78 | 25 | 4.2 | 7.7 | 166.7 |
| M1-600 | 0.78 | 28 | 2.8 | 5.2 | 187.6 |
| M1-1440 | 0.78 | 34 | 1.4 | 2.7 | 229.3 |

| Storm | Z2 | Rainfall (mm) | Rainfall Intensity (mm/hr) | Qmax (L/s) | Volume (m3) |
|---|---|---|---|---|---|
| M2-5 | 0.79 | 6 | 73.9 | 137.2 | 41.2 |
| M2-10 | 0.79 | 8 | 50.4 | 93.5 | 56.1 |

| | | | | | |
|---|---|---|---|---|---|
| M2-15 | 0.80 | 10 | 41.4 | 76.8 | 69.1 |
| M2-30 | 0.80 | 13 | 25.7 | 47.6 | 85.7 |
| M2-60 | 0.81 | 16 | 16.2 | 30.1 | 108.2 |
| M2-120 | 0.82 | 20 | 9.8 | 18.2 | 131.1 |
| M2-240 | 0.83 | 23 | 5.8 | 10.7 | 154.5 |
| M2-360 | 0.83 | 27 | 4.4 | 8.2 | 177.9 |
| M2-600 | 0.84 | 30 | 3.0 | 5.6 | 201.1 |
| M2-1440 | 0.84 | 37 | 1.5 | 2.9 | 248.1 |

| Storm | Z2 | Rainfall (mm) | Rainfall Intensity (mm/hr) | Qmax (L/s) | Volume (m3) |
|---|---|---|---|---|---|
| M30-5 | 1.46 | 11 | 136.9 | 254.0 | 76.2 |
| M30-10 | 1.49 | 16 | 95.0 | 176.4 | 105.8 |
| M30-15 | 1.51 | 20 | 78.6 | 145.9 | 131.3 |
| M30-30 | 1.53 | 24 | 49.0 | 90.9 | 163.5 |
| M30-60 | 1.54 | 31 | 30.9 | 57.3 | 206.2 |
| M30-120 | 1.54 | 37 | 18.4 | 34.2 | 246.2 |
| M30-240 | 1.52 | 43 | 10.6 | 19.8 | 284.6 |
| M30-360 | 1.50 | 48 | 8.0 | 14.9 | 321.5 |
| M30-600 | 1.49 | 53 | 5.3 | 9.9 | 357.2 |
| M30-1440 | 1.45 | 64 | 2.7 | 4.9 | 425.6 |

| Storm | Z2 | Rainfall (mm) | Rainfall Intensity (mm/hr) | Qmax (L/s) | Volume (m3) |
|---|---|---|---|---|---|
| M100-5 | 1.86 | 15 | 174.3 | 323.4 | 97.0 |
| M100-10 | 1.93 | 20 | 122.5 | 227.3 | 136.4 |
| M100-15 | 1.96 | 25 | 101.8 | 188.9 | 170.0 |
| M100-30 | 2.00 | 32 | 63.9 | 118.6 | 213.6 |
| M100-60 | 2.03 | 41 | 40.6 | 75.3 | 271.2 |
| M100-120 | 2.01 | 48 | 24.2 | 44.8 | 322.9 |
| M100-240 | 1.99 | 56 | 13.9 | 25.8 | 371.5 |
| M100-360 | 1.95 | 62 | 10.4 | 19.3 | 416.0 |
| M100-600 | 1.91 | 69 | 6.9 | 12.8 | 460.3 |
| M100-1440 | 1.83 | 80 | 3.3 | 6.2 | 536.7 |

| Storm +25% climate change | Rainfall (mm) | Rainfall Intensity (mm/hr) | Qmax (L/s) | Volume (m3) |
|---|---|---|---|---|
| M100-5 + 45% | 21.1 | 252.7 | 468.9 | 140.7 |
| M100-10 + 45% | 29.6 | 177.6 | 329.6 | 197.8 |
| M100-15 + 45% | 36.9 | 147.6 | 274.0 | 246.6 |
| M100-30 + 45% | 46.4 | 92.7 | 172.0 | 309.7 |
| M100-60 + 45% | 58.9 | 58.9 | 109.2 | 393.3 |
| M100-120 + 45% | 70.1 | 35.0 | 65.0 | 468.2 |
| M100-240 + 45% | 80.6 | 20.2 | 37.4 | 538.7 |
| M100-360 + 45% | 90.3 | 15.0 | 27.9 | 603.2 |
| M100-600 + 45% | 99.9 | 10.0 | 18.5 | 667.4 |
| M100-1440 + 45% | 116.5 | 4.9 | 9.0 | 778.3 |

## Summary of Results for 30 year Return Period

Half Drain Time : 68 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 15 min Summer | 82.308 | 0.308 | 0.0 | 20.0 | 20.0 | 90.8 | O K |
| 30 min Summer | 82.385 | 0.385 | 0.0 | 20.1 | 20.1 | 113.4 | O K |
| 60 min Summer | 82.438 | 0.438 | 0.0 | 20.1 | 20.1 | 128.9 | O K |
| 120 min Summer | 82.463 | 0.463 | 0.0 | 20.1 | 20.1 | 136.2 | O K |
| 180 min Summer | 82.455 | 0.455 | 0.0 | 20.1 | 20.1 | 134.1 | O K |
| 240 min Summer | 82.437 | 0.437 | 0.0 | 20.1 | 20.1 | 128.6 | O K |
| 360 min Summer | 82.389 | 0.389 | 0.0 | 20.1 | 20.1 | 114.6 | O K |
| 480 min Summer | 82.343 | 0.343 | 0.0 | 20.1 | 20.1 | 101.1 | O K |
| 600 min Summer | 82.303 | 0.303 | 0.0 | 20.0 | 20.0 | 89.3 | O K |
| 720 min Summer | 82.270 | 0.270 | 0.0 | 19.7 | 19.7 | 79.5 | O K |
| 960 min Summer | 82.221 | 0.221 | 0.0 | 19.2 | 19.2 | 65.1 | O K |
| 1440 min Summer | 82.177 | 0.177 | 0.0 | 16.2 | 16.2 | 52.3 | O K |
| 2160 min Summer | 82.146 | 0.146 | 0.0 | 12.6 | 12.6 | 43.1 | O K |
| 2880 min Summer | 82.129 | 0.129 | 0.0 | 10.4 | 10.4 | 38.0 | O K |
| 4320 min Summer | 82.108 | 0.108 | 0.0 | 7.8 | 7.8 | 31.8 | O K |
| 5760 min Summer | 82.096 | 0.096 | 0.0 | 6.3 | 6.3 | 28.2 | O K |
| 7200 min Summer | 82.087 | 0.087 | 0.0 | 5.3 | 5.3 | 25.6 | O K |
| 8640 min Summer | 82.080 | 0.080 | 0.0 | 4.6 | 4.6 | 23.7 | O K |
| 10080 min Summer | 82.075 | 0.075 | 0.0 | 4.1 | 4.1 | 22.2 | O K |
| 15 min Winter | 82.348 | 0.348 | 0.0 | 20.1 | 20.1 | 102.6 | O K |
| 30 min Winter | 82.438 | 0.438 | 0.0 | 20.1 | 20.1 | 128.9 | O K |
| 60 min Winter | 82.501 | 0.501 | 0.0 | 20.1 | 20.1 | 147.4 | O K |
| 120 min Winter | 82.519 | 0.519 | 0.0 | 20.1 | 20.1 | 152.8 | O K |
| 180 min Winter | 82.500 | 0.500 | 0.0 | 20.1 | 20.1 | 147.3 | O K |
| 240 min Winter | 82.467 | 0.467 | 0.0 | 20.1 | 20.1 | 137.5 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 65.439 | 0.0 | 100.9 | 17 |
| 30 min Summer | 43.443 | 0.0 | 134.4 | 31 |
| 60 min Summer | 27.653 | 0.0 | 172.1 | 52 |
| 120 min Summer | 17.113 | 0.0 | 213.2 | 86 |
| 180 min Summer | 12.792 | 0.0 | 239.1 | 120 |
| 240 min Summer | 10.359 | 0.0 | 258.2 | 154 |
| 360 min Summer | 7.651 | 0.0 | 286.1 | 220 |
| 480 min Summer | 6.171 | 0.0 | 307.7 | 282 |
| 600 min Summer | 5.219 | 0.0 | 325.3 | 344 |
| 720 min Summer | 4.550 | 0.0 | 340.4 | 402 |
| 960 min Summer | 3.662 | 0.0 | 365.2 | 514 |
| 1440 min Summer | 2.694 | 0.0 | 402.8 | 750 |
| 2160 min Summer | 1.978 | 0.0 | 444.5 | 1104 |
| 2880 min Summer | 1.588 | 0.0 | 475.7 | 1472 |
| 4320 min Summer | 1.164 | 0.0 | 522.4 | 2204 |
| 5760 min Summer | 0.933 | 0.0 | 559.2 | 2936 |
| 7200 min Summer | 0.785 | 0.0 | 588.3 | 3672 |
| 8640 min Summer | 0.682 | 0.0 | 613.1 | 4400 |
| 10080 min Summer | 0.605 | 0.0 | 634.3 | 5136 |
| 15 min Winter | 65.439 | 0.0 | 113.2 | 17 |
| 30 min Winter | 43.443 | 0.0 | 150.7 | 31 |
| 60 min Winter | 27.653 | 0.0 | 192.9 | 58 |
| 120 min Winter | 17.113 | 0.0 | 238.8 | 92 |
| 180 min Winter | 12.792 | 0.0 | 267.9 | 132 |
| 240 min Winter | 10.359 | 0.0 | 289.3 | 168 |

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## Summary of Results for 30 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 360 min Winter | 82.389 | 0.389 | 0.0 | 20.1 | 20.1 | 114.7 | O K |
| 480 min Winter | 82.320 | 0.320 | 0.0 | 20.0 | 20.0 | 94.2 | O K |
| 600 min Winter | 82.264 | 0.264 | 0.0 | 19.7 | 19.7 | 77.7 | O K |
| 720 min Winter | 82.223 | 0.223 | 0.0 | 19.2 | 19.2 | 65.6 | O K |
| 960 min Winter | 82.184 | 0.184 | 0.0 | 16.9 | 16.9 | 54.2 | O K |
| 1440 min Winter | 82.148 | 0.148 | 0.0 | 12.9 | 12.9 | 43.7 | O K |
| 2160 min Winter | 82.123 | 0.123 | 0.0 | 9.6 | 9.6 | 36.1 | O K |
| 2880 min Winter | 82.108 | 0.108 | 0.0 | 7.7 | 7.7 | 31.7 | O K |
| 4320 min Winter | 82.090 | 0.090 | 0.0 | 5.7 | 5.7 | 26.6 | O K |
| 5760 min Winter | 82.080 | 0.080 | 0.0 | 4.6 | 4.6 | 23.6 | O K |
| 7200 min Winter | 82.073 | 0.073 | 0.0 | 3.8 | 3.8 | 21.4 | O K |
| 8640 min Winter | 82.068 | 0.068 | 0.0 | 3.4 | 3.4 | 19.9 | O K |
| 10080 min Winter | 82.063 | 0.063 | 0.0 | 3.0 | 3.0 | 18.6 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 360 min Winter | 7.651 | 0.0 | 320.5 | 236 |
| 480 min Winter | 6.171 | 0.0 | 344.7 | 298 |
| 600 min Winter | 5.219 | 0.0 | 364.5 | 356 |
| 720 min Winter | 4.550 | 0.0 | 381.3 | 406 |
| 960 min Winter | 3.662 | 0.0 | 409.2 | 520 |
| 1440 min Winter | 2.694 | 0.0 | 451.2 | 752 |
| 2160 min Winter | 1.978 | 0.0 | 497.9 | 1112 |
| 2880 min Winter | 1.588 | 0.0 | 532.8 | 1472 |
| 4320 min Winter | 1.164 | 0.0 | 585.3 | 2204 |
| 5760 min Winter | 0.933 | 0.0 | 626.3 | 2936 |
| 7200 min Winter | 0.785 | 0.0 | 659.0 | 3672 |
| 8640 min Winter | 0.682 | 0.0 | 686.7 | 4400 |
| 10080 min Winter | 0.605 | 0.0 | 710.7 | 5136 |

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## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 30 | Cv (Summer) | 0.750 |
| Region | England and Wales | Cv (Winter) | 0.840 |
| M5-60 (mm) | 18.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.357 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +0 |

## Time Area Diagram

Total Area (ha) 0.833

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.833 |

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## Model Details

Storage is Online Cover Level (m) 84.200

## Cellular Storage Structure

Invert Level (m) 82.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 310.0 | 0.0 | 1.200 | 310.0 | 0.0 | 1.201 | 0.0 | 0.0 |

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0197-2020-1200-2020 |
| Design Head (m) | 1.200 |
| Design Flow (l/s) | 20.2 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 197 |
| Invert Level (m) | 82.000 |
| Minimum Outlet Pipe Diameter (mm) | 225 |
| Suggested Manhole Diameter (mm) | 1500 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.200 | 20.2 | Kick-Flo® | 0.829 | 16.9 |
| Flush-Flo™ | 0.379 | 20.1 | Mean Flow over Head Range | - | 17.2 |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 6.8 | 0.800 | 17.6 | 2.000 | 25.7 | 4.000 | 35.9 | 7.000 | 47.1 |
| 0.200 | 18.4 | 1.000 | 18.5 | 2.200 | 27.0 | 4.500 | 38.0 | 7.500 | 48.7 |
| 0.300 | 19.9 | 1.200 | 20.2 | 2.400 | 28.1 | 5.000 | 40.0 | 8.000 | 50.2 |
| 0.400 | 20.1 | 1.400 | 21.7 | 2.600 | 29.2 | 5.500 | 41.9 | 8.500 | 51.7 |
| 0.500 | 19.9 | 1.600 | 23.1 | 3.000 | 31.3 | 6.000 | 43.7 | 9.000 | 53.2 |
| 0.600 | 19.5 | 1.800 | 24.5 | 3.500 | 33.7 | 6.500 | 45.4 | 9.500 | 54.6 |

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## Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 152 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 15 min Summer | 82.603 | 0.603 | 0.0 | 20.1 | 20.1 | 177.6 | O K |
| 30 min Summer | 82.785 | 0.785 | 0.0 | 20.1 | 20.1 | 231.1 | O K |
| 60 min Summer | 82.948 | 0.948 | 0.0 | 20.1 | 20.1 | 279.1 | O K |
| 120 min Summer | 83.037 | 1.037 | 0.0 | 20.1 | 20.1 | 305.3 | O K |
| 180 min Summer | 83.044 | 1.044 | 0.0 | 20.1 | 20.1 | 307.4 | O K |
| 240 min Summer | 83.030 | 1.030 | 0.0 | 20.1 | 20.1 | 303.4 | O K |
| 360 min Summer | 82.978 | 0.978 | 0.0 | 20.1 | 20.1 | 287.9 | O K |
| 480 min Summer | 82.920 | 0.920 | 0.0 | 20.1 | 20.1 | 270.9 | O K |
| 600 min Summer | 82.857 | 0.857 | 0.0 | 20.1 | 20.1 | 252.5 | O K |
| 720 min Summer | 82.785 | 0.785 | 0.0 | 20.1 | 20.1 | 231.3 | O K |
| 960 min Summer | 82.655 | 0.655 | 0.0 | 20.1 | 20.1 | 192.9 | O K |
| 1440 min Summer | 82.451 | 0.451 | 0.0 | 20.1 | 20.1 | 132.8 | O K |
| 2160 min Summer | 82.273 | 0.273 | 0.0 | 19.8 | 19.8 | 80.4 | O K |
| 2880 min Summer | 82.201 | 0.201 | 0.0 | 18.5 | 18.5 | 59.3 | O K |
| 4320 min Summer | 82.158 | 0.158 | 0.0 | 14.0 | 14.0 | 46.4 | O K |
| 5760 min Summer | 82.136 | 0.136 | 0.0 | 11.3 | 11.3 | 40.0 | O K |
| 7200 min Summer | 82.122 | 0.122 | 0.0 | 9.5 | 9.5 | 35.8 | O K |
| 8640 min Summer | 82.111 | 0.111 | 0.0 | 8.2 | 8.2 | 32.8 | O K |
| 10080 min Summer | 82.104 | 0.104 | 0.0 | 7.3 | 7.3 | 30.5 | O K |
| 15 min Winter | 82.680 | 0.680 | 0.0 | 20.1 | 20.1 | 200.2 | O K |
| 30 min Winter | 82.889 | 0.889 | 0.0 | 20.1 | 20.1 | 261.9 | O K |
| 60 min Winter | 83.074 | 1.074 | 0.0 | 20.1 | 20.1 | 316.3 | O K |
| 120 min Winter | 83.189 | 1.189 | 0.0 | 20.1 | 20.1 | 350.2 | O K |
| 180 min Winter | 83.194 | 1.194 | 0.0 | 20.1 | 20.1 | 351.7 | O K |
| 240 min Winter | 83.174 | 1.174 | 0.0 | 20.1 | 20.1 | 345.8 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 122.490 | 0.0 | 190.0 | 18 |
| 30 min Summer | 82.125 | 0.0 | 255.1 | 32 |
| 60 min Summer | 52.627 | 0.0 | 328.1 | 62 |
| 120 min Summer | 32.639 | 0.0 | 407.1 | 118 |
| 180 min Summer | 24.356 | 0.0 | 455.8 | 148 |
| 240 min Summer | 19.667 | 0.0 | 490.8 | 180 |
| 360 min Summer | 14.425 | 0.0 | 540.0 | 248 |
| 480 min Summer | 11.585 | 0.0 | 578.2 | 318 |
| 600 min Summer | 9.765 | 0.0 | 609.3 | 388 |
| 720 min Summer | 8.488 | 0.0 | 635.5 | 454 |
| 960 min Summer | 6.797 | 0.0 | 678.6 | 578 |
| 1440 min Summer | 4.962 | 0.0 | 742.8 | 810 |
| 2160 min Summer | 3.615 | 0.0 | 812.5 | 1148 |
| 2880 min Summer | 2.883 | 0.0 | 864.1 | 1472 |
| 4320 min Summer | 2.093 | 0.0 | 940.5 | 2204 |
| 5760 min Summer | 1.666 | 0.0 | 998.7 | 2936 |
| 7200 min Summer | 1.394 | 0.0 | 1044.9 | 3672 |
| 8640 min Summer | 1.205 | 0.0 | 1083.6 | 4400 |
| 10080 min Summer | 1.065 | 0.0 | 1116.7 | 5096 |
| 15 min Winter | 122.490 | 0.0 | 212.9 | 18 |
| 30 min Winter | 82.125 | 0.0 | 285.9 | 32 |
| 60 min Winter | 52.627 | 0.0 | 367.6 | 60 |
| 120 min Winter | 32.639 | 0.0 | 456.1 | 116 |
| 180 min Winter | 24.356 | 0.0 | 510.6 | 166 |
| 240 min Winter | 19.667 | 0.0 | 549.7 | 190 |

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## Summary of Results for 100 year Return Period (+45%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 360 min Winter | 83.100 | 1.100 | 0.0 | 20.1 | 20.1 | 324.0 | O K |
| 480 min Winter | 83.015 | 1.015 | 0.0 | 20.1 | 20.1 | 298.8 | O K |
| 600 min Winter | 82.922 | 0.922 | 0.0 | 20.1 | 20.1 | 271.5 | O K |
| 720 min Winter | 82.816 | 0.816 | 0.0 | 20.1 | 20.1 | 240.3 | O K |
| 960 min Winter | 82.607 | 0.607 | 0.0 | 20.1 | 20.1 | 178.7 | O K |
| 1440 min Winter | 82.327 | 0.327 | 0.0 | 20.1 | 20.1 | 96.4 | O K |
| 2160 min Winter | 82.189 | 0.189 | 0.0 | 17.4 | 17.4 | 55.7 | O K |
| 2880 min Winter | 82.158 | 0.158 | 0.0 | 14.0 | 14.0 | 46.5 | O K |
| 4320 min Winter | 82.128 | 0.128 | 0.0 | 10.2 | 10.2 | 37.7 | O K |
| 5760 min Winter | 82.111 | 0.111 | 0.0 | 8.2 | 8.2 | 32.8 | O K |
| 7200 min Winter | 82.100 | 0.100 | 0.0 | 6.8 | 6.8 | 29.6 | O K |
| 8640 min Winter | 82.092 | 0.092 | 0.0 | 5.9 | 5.9 | 27.2 | O K |
| 10080 min Winter | 82.086 | 0.086 | 0.0 | 5.2 | 5.2 | 25.3 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 360 min Winter | 14.425 | 0.0 | 604.9 | 268 |
| 480 min Winter | 11.585 | 0.0 | 647.7 | 344 |
| 600 min Winter | 9.765 | 0.0 | 682.4 | 420 |
| 720 min Winter | 8.488 | 0.0 | 711.8 | 494 |
| 960 min Winter | 6.797 | 0.0 | 760.1 | 614 |
| 1440 min Winter | 4.962 | 0.0 | 832.1 | 824 |
| 2160 min Winter | 3.615 | 0.0 | 910.0 | 1124 |
| 2880 min Winter | 2.883 | 0.0 | 967.9 | 1472 |
| 4320 min Winter | 2.093 | 0.0 | 1053.5 | 2204 |
| 5760 min Winter | 1.666 | 0.0 | 1118.6 | 2936 |
| 7200 min Winter | 1.394 | 0.0 | 1170.3 | 3672 |
| 8640 min Winter | 1.205 | 0.0 | 1213.7 | 4408 |
| 10080 min Winter | 1.065 | 0.0 | 1251.0 | 5048 |

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## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | England and Wales | Cv (Winter) | 0.840 |
| M5-60 (mm) | 18.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.357 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +45 |

## Time Area Diagram

Total Area (ha) 0.833

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.833 |

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## Model Details

Storage is Online Cover Level (m) 84.200

## Cellular Storage Structure

Invert Level (m) 82.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 310.0 | 0.0 | 1.200 | 310.0 | 0.0 | 1.201 | 0.0 | 0.0 |

## Hydro-Brake® Optimum Outflow Control

| | |
|---|---|
| Unit Reference | MD-SHE-0197-2020-1200-2020 |
| Design Head (m) | 1.200 |
| Design Flow (l/s) | 20.2 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 197 |
| Invert Level (m) | 82.000 |
| Minimum Outlet Pipe Diameter (mm) | 225 |
| Suggested Manhole Diameter (mm) | 1500 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.200 | 20.2 | Kick-Flo® | 0.829 | 16.9 |
| Flush-Flo™ | 0.379 | 20.1 | Mean Flow over Head Range | - | 17.2 |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 6.8 | 0.800 | 17.6 | 2.000 | 25.7 | 4.000 | 35.9 | 7.000 | 47.1 |
| 0.200 | 18.4 | 1.000 | 18.5 | 2.200 | 27.0 | 4.500 | 38.0 | 7.500 | 48.7 |
| 0.300 | 19.9 | 1.200 | 20.2 | 2.400 | 28.1 | 5.000 | 40.0 | 8.000 | 50.2 |
| 0.400 | 20.1 | 1.400 | 21.7 | 2.600 | 29.2 | 5.500 | 41.9 | 8.500 | 51.7 |
| 0.500 | 19.9 | 1.600 | 23.1 | 3.000 | 31.3 | 6.000 | 43.7 | 9.000 | 53.2 |
| 0.600 | 19.5 | 1.800 | 24.5 | 3.500 | 33.7 | 6.500 | 45.4 | 9.500 | 54.6 |

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